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c.) Remarks

In the office action of November 17, claims 1, 5, 6, 12, 14, 15, 27 and 28 have been rejected. Claims 1, 27, and 28 are amended herein. Claims 2-4, 7-11, 13, and 16-17 remain withdrawn from consideration. Claims 18-26, being non-elected claims from an earlier restriction requirement, are canceled as of this response. Support for the amendments to Claims 1, 27, and 28 appear at page 8, ll. 6-7, at page 13, ll. 8-10, and at page 19, ll. 12-19. These portions of the specification make clear to one of skill in the art that the application of the electric charge is to be applied continuously or substantially continuously throughout the process.

The rejections and objections entered in the office action of November 17, 2004 are summarized below.

Outstanding Rejections/Objections

The Examiner has entered or maintained the following objections/rejections:

1. Claim 28 is rejected under 35 USC § 102(b) as being anticipated by U.S. Patent 4,505,758 to Carson ("Carson '758").
2. Claims 1, 5-6, 12, and 27 are rejected under 35 USC § 103(a), as being unpatentable over Carson '758 in view of U.S. Patent 3,933,606 to Harms ("Harms '606").
3. Claims 14-15 are rejected under 35 USC § 103(a) as being unpatentable over Carson '758 in view of Harms '606, and further in view of U.S. Patent 6,451,210 to Sivavec et al ("Sivavec '210").

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1. Rejection of Claim 28 under 35 USC § 102(b)

The examiner has rejected claim 28 are rejected under 35 USC § 102(b), as being unpatentable over Carson '758.

With the present amendments to the claims, Applicants believe that the basis for the Examiner's rejection has been removed and that the claim is in condition for allowance. The present amendments clarify the scope of the claims.

Carson '758 is concerned with cleaning heat exchanger tubes "by applying an electric current to a portion of the tubes for brief time periods to heat such tubes to a temperature sufficient to melt or soften deposits therein, while simultaneously continuing to pass liquid therethrough. (Abstract of Carson '758; emphasis added). This idea of short, intermittent application of voltage is reiterated in the specification and in the claims of Carson '758. For example, at col. 3, ll. 59-62, the Carson '758 specification states:

The time period for which current flows through each portion of a cooler will often be much less than one minute, preferably no more than that amount, and certainly will be less than five minutes.

In the only claim of Carson '758 (col. 6, ll. 11-13), it is recited that the claimed invention requires "applying for a short period of time an electric current to at least a portion of said heat exchanger tubes." The reason that Carson '758 limits his teaching to short, intermittent applications of voltage is because of the nature of the problem that Carson '758 is attempting to solve. Carson '758 is concerned with the build-up of heavy hydrocarbons and other high molecular weight petroleum components, e.g., coronene (col. 4 ll. 8-9). At col. 1, ll. 30-48, the Carson '758 specification recites:

Certain operations in a petroleum refinery are particularly susceptible to solids depositing in coolers. Among these operations are hydrocracking of distillates and

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heavy gas oils. The deposits may comprise paraffin waxes and condensed ring aromatics. Another example of a problem area in a refinery is deasphalting, where asphalt droplets entrained in a process stream solidify and accumulate in the cooler when the stream is cooled. Refinery units normally operate on a continuous basis, shutting down only once a year for maintenance and repair. To avoid a shut-down, adverse operating conditions may be accepted as the lesser of the two evils. For example, a higher temperature stream from a cooler will have undesirable effects on a vapor-liquid separator and a compressor, which are commonly located downstream in a refinery. It is usually desirable to run both of these pieces of equipment at as low a temperature as possible, in order to increase yield of product and decrease maintenance expense.

The method of Carson '758 operates by applying a large enough voltage so as to result in resistive heating of the heat exchanger elements. This heating melts the high molecular weight petroleum components. As seen in the above-recited portion of the Carson '758 specification, however:

[A] higher temperature stream from a cooler will have undesirable effects on a vapor-liquid separator and a compressor, which are commonly located downstream in a refinery. It is usually desirable to run both of these pieces of equipment at as low a temperature as possible...

Col. 1, ll. 42-47. It is for this reason that Carson '758 uses short, intermittent applications of voltage. Long-term high temperatures are not desirable, yet it is the high temperatures themselves which cause the desired results of Carson '758 (melting of the high molecular weight petroleum components which causing fouling of heat exchangers).

In the present invention, much lower voltages are preferable, but these voltages are applied continuously or substantially continuously, throughout the underlying process. This is now recited in the method and apparatus claims. The present amendments to the claims now make this clear. Support for the amendments to Claims 1, 27, and 28 appear at page 8, ll. 6-7 (teaches typically constant electric charge), and at page 13, ll. 8-10, (teaches that voltage must be of sufficient magnitude to attract or repel foulants; one of skill in the art would know that a zero magnitude voltage is not enough). Also, at page 19, ll. 12-19, the instant specification teaches:

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As we have discussed, in any design, the application of a repulsive charge on the tubes is useful. These are the critical surfaces at which heat transfer occurs. The flow of the hot CSO contacts the shell-side surface of the tubes in a manner described as cross-flow (FIG. 7). This flow pattern (71) creates a vortex (72) behind the tube (73) which promotes good heat transfer. Over time, fouling develops on the surface of these tubes causing heat transfer efficiency to decline. As this proceeds, the fouling will increase to a point where the equipment must be taken off-line and cleaned. Applying the electric charge to tube wall (74) of the heat exchanger will prevent or significantly reduce the frequency of maintenance.

(emphasis added). Clearly, the specification is teaching that since fouling develops over time, the application of the charge should be on or substantially close to, spanning the time frame of the potential fouling. The instant invention is primarily concerned with the prevention of fouling by catalyst particulates (see page 12, ll. 8-11).

In light of the amendments to the claims and the arguments presented herein, Applicants believe that claim 28 is in condition for allowance and respectfully request that the Examiner withdraw the outstanding rejection of claim 28, under 35 USC § 102(b).

2. Rejection of Claims 1, 5-6, 12, and 27 under 35 USC § 103(a)

The examiner has rejected claims 1, 5-6, 12, and 27 under 35 USC § 103(a) as being unpatentable over Carson '758 in view of Harms '606. Applicants assert that the present amendments overcome this rejection.

The primary reference in this combination (Carson '758) is the only one that is concerned with the prevention of fouling in hydrocarbon-based processes using the application of a voltage to a piece of process equipment. Harms '606 is concerned with contaminated water streams. However, as we discussed above, Carson '758 clearly does not envision a continuous or substantially continuous application of voltage. This is due to the nature of the problem Carson '758 is solving (prevention of high molecular weight foulant accumulation by melting through resistive heating). Carson '758 teaches away from a continuous or substantially continuous

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application of voltage. As seen in the above-recited portion of the Carson '758 specification, however:

[A] higher temperature stream from a cooler will have undesirable effects on a vapor-liquid separator and a compressor, which are commonly located downstream in a refinery. It is usually desirable to run both of these pieces of equipment at as low a temperature as possible...

Col. 1, ll. 42-47. It is for this reason that Carson '758 uses short, intermittent applications of voltage. Long-term high temperatures are not desirable, yet it is the high temperatures themselves which cause the desired results of Carson '758 (melting of the high molecular weight petroleum components) which causing fouling of heat exchangers.

Because Carson '758 teaches away from the presently pending claims, it is inappropriate to combine Carson '758 with Harms '606 (or any other reference) for a proper rejection under 35 USC § 103(a). For these reasons, and in light of the amendments to the claims, applicants believe that the pending claims are in condition for allowance and respectfully request that the Examiner withdraw the outstanding rejection of claims 1, 5-6, 12, and 27 under 35 USC § 103(a).

3. Rejection of Claims 14-15 under 35 USC § 103(a)

The examiner has rejected claims 14-15 under 35 USC § 103(a) as being unpatentable over Carson '758 in view of Harms '606 and further in view of Sivavec '210. Applicants assert that the present amendments overcome this rejection.

The primary reference in this combination (Carson '758) is the only one that is concerned with the prevention of fouling in hydrocarbon-based processes using the application of a voltage to a piece of process equipment. Harms '606 is concerned with contaminated water streams. Sivavec '210 is silent as to the nature of the stream to be cleaned, but fails to teach the use of the

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application of a voltage or a current to a piece of process equipment to prevent the fouling thereof. However, as we discussed for the previous rejection, Carson '758 clearly does not envision a continuous or substantially continuous application of voltage. This is due to the nature of the problem Carson '758 is solving (prevention of high molecular weight foulant accumulation by melting through resistive heating). Carson '758 teaches away from a continuous or substantially continuous application of voltage. As seen in the above-recited portion of the Carson '758 specification, however:

[A] higher temperature stream from a cooler will have undesirable effects on a vapor-liquid separator and a compressor, which are commonly located downstream in a refinery. It is usually desirable to run both of these pieces of equipment at as low a temperature as possible...

Col. 1, ll. 42-47. It is for this reason that Carson '758 uses short, intermittent applications of voltage. Long-term high temperatures are not desirable, yet it is the high temperatures themselves which cause the desired results of Carson '758 (melting of the high molecular weight petroleum components) which causing fouling of heat exchangers.

Because Carson '758 teaches away from the presently pending claims, it is inappropriate to combine Carson '758 with Harms '606 and Sivavec '210 (or with any other reference) for a proper rejection under 35 USC § 103(a). For these reasons, and in light of the amendments to the claims, applicants believe that the pending claims are in condition for allowance and respectfully request that the Examiner withdraw the outstanding rejection of claims 14-15 under 35 USC § 103(a).

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d.) Conclusions

In light of the arguments and amendments presented herein, Applicants also assert that the pending claims are now in condition for allowance. Because the Examiner's rejections have been properly addressed, Applicants respectfully request withdrawal of the outstanding rejections. Accordingly, Applicants earnestly request allowance of the application. This is intended to be a complete response. If any issues remain outstanding, please contact the undersigned for resolution of the same.

Applicants understand that under 37 CFR 1.141, they are entitled to consideration of claims to additional species which are written in dependent form or which otherwise include all of the limitations of an allowed generic claim. Accordingly, Applicants believe that claims 2-4, 7-11, 13, and 16-17 fall into this category. In the first office action, the Examiner imposed a species requirement and requested withdrawal from consideration of the non-elected species.

Applicants believe that no fees are due or associated with the filing of this document. However, if Applicants are in error, the Commissioner is hereby authorized to draw any additional fees associated with this filing from Deposit Account No. 06-2375, under Order No. P02104US0/10100157, from which the undersigned is authorized to draw.

Respectfully submitted,

Date: February 8, 2005

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